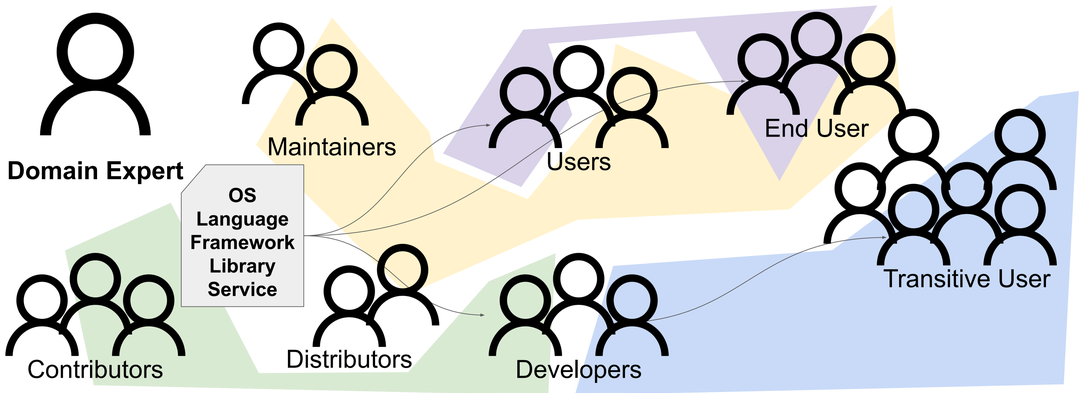
Enabling API Upgrades

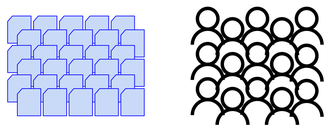
Many people cannot afford key upgrades!

Software ecosystems are… ***messy***



Tools must deal with many **<u>social</u> challenges**

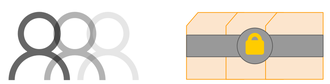
↑ Scale
to the number of projects and teams



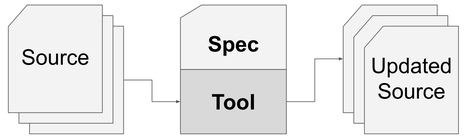
Expertise ↓
of the developers and their users

↑ Priorities
of different developers and users

Visibility↓
into existing users and their code



Program Transformations for **Domain Experts**



txl CUBIX
gofmt clang::transformer
Semgrep Comby

Type Preservation: upgrade **reliability** over **all code**

If $\Delta \mid \Gamma \vdash e : t$, $\Delta \mid \Gamma \vdash r$ **ok**, $\Delta \mid \Gamma \vdash e \rightarrow_r e'$, **then** $\Delta \mid \Gamma \vdash e' : t$

where $r = \textbf{with}\ \Pi\ \textbf{M:}\ p\ \textbf{>>}\ q$ with $\Pi = \$x_i : t_i$

***Semantic* Synthesis:** **scale** existing approaches for **everyone**

```
M: sleep($expr)
>> sleep(to<sec>($expr))
```

inference

`M: to<secs>($1 + $r)` `>> to<secs>($1) + to<secs>($r)`	`M: to<secs>($1:secs - $r:secs)` `>> $1 - $r`
`M: to<secs>($1 / $r)` `>> to<secs>($1) / $r`	`M: to<secs>($1:time - $r:time)` `>> $1 - $r`
`M: to<secs>($1 % $r)` `>> to<secs>($1) % to<secs>($r)`	`M: to<secs>($1 * $r:secs)` `>> $1 * $r`

Change in Software Ecosystems (PLATEAU 2021)
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